Code Quality Metrics

Why Evolution is needed for Software Metrics

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Overview

- TIOBE Software
- Why are Code Quality Metrics hardly used?
- The Code Quality Metric Evolution Approach
- Two TIOBE Wake-up Calls: a new Dilemma
- Extending the Approach

Dream...

Product Quality Methods

- Software Assessment/Certification
  - Manual and laborious process
  - Good results

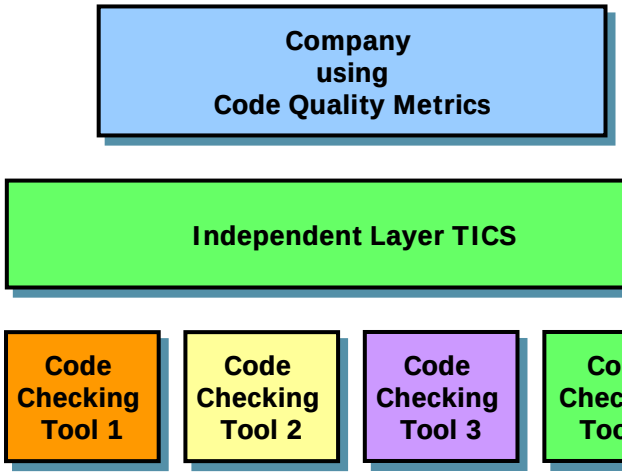
- Automatic Software Monitoring
  - Automated process
  - Partial results

TIOBE Software Mission

TIOBE software is a service company that supports its customers with obtaining and monitoring software quality data

This is achieved by applying its TICS framework and in-depth knowledge of static analysis technologies

TICS Solution



Customers using the TICS Approach

- 250+ software projects
- 100+ million lines of code

Assembléon, ATSO, océ, Thomson, elamedical, MH gaming, PHILIPS, UNISYS, EVS, MICRONAS, SIEMENS VDO, FEI COMPANY, NXP, THALES

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A Short History of Software Metrics

1976	1974	1977	1963
			
Cyclomatic Complexity	Cohesion Coupling	Halstead Metric	Code Coverage

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Why are Software Metrics not used?

- Other paradigms were dominant so far
  - Process quality metrics: SEI's CMM(I)
  - Metrics on demand: GQM
- Essential characteristics missing
  - Clear definition
  - Normative values
  - Reality check

Example: Cyclomatic Complexity

- What does “cyclomatic” mean?
- Definition: CC = E – N + 2P
  - E = Number of edges of the graph
  - N = Number of nodes of the graph
  - P = Number of connected components
- What is the scope? Program? Class? Function?
- What is the norm? McCabe: 10 is too much
- CC of “if” and “while” statement is equal

But there is also good News!

- Static confidence factor (TIOBE)
  - Metric defined by evolution (2003 - 2009)
  - Measuring the static quality of a program
- Starting Point: coding standard violations
  - Layout issues: right indentation
  - Naming conventions: methods lowercase
  - Programming errors: compare floats

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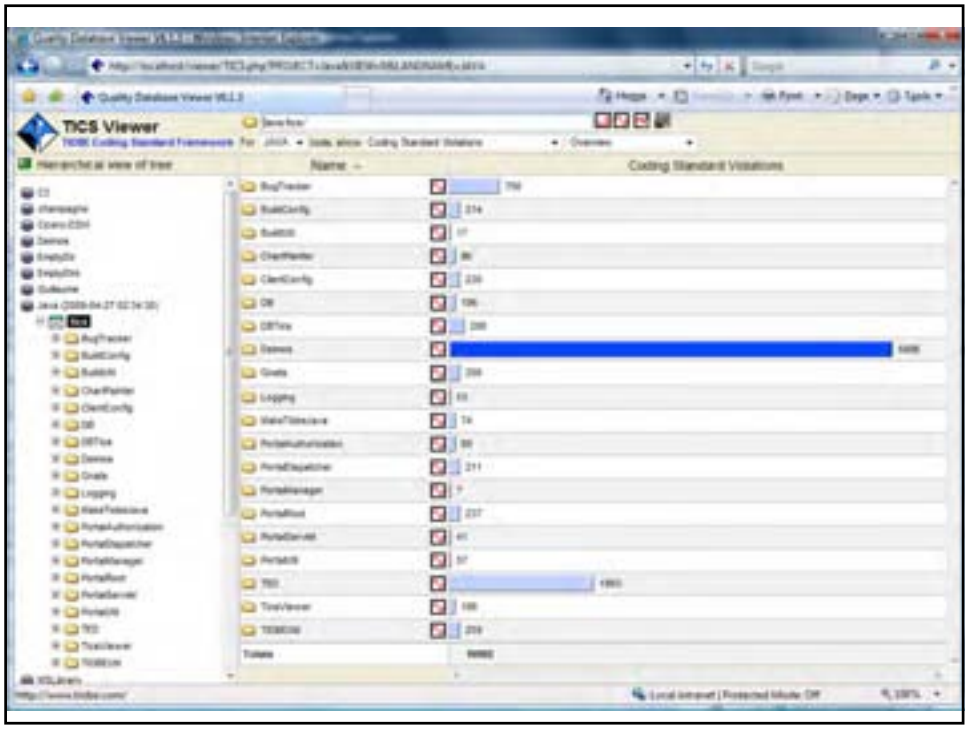

Coding Standard Violations improved

- Number of violations don't say much:
  - What does 5,886 violations mean?
  - Should we fire everybody?
  - Or have a big party?
- Improvement: count per source lines of code
  - This allows for comparison
  - New definition: violations/KLOC

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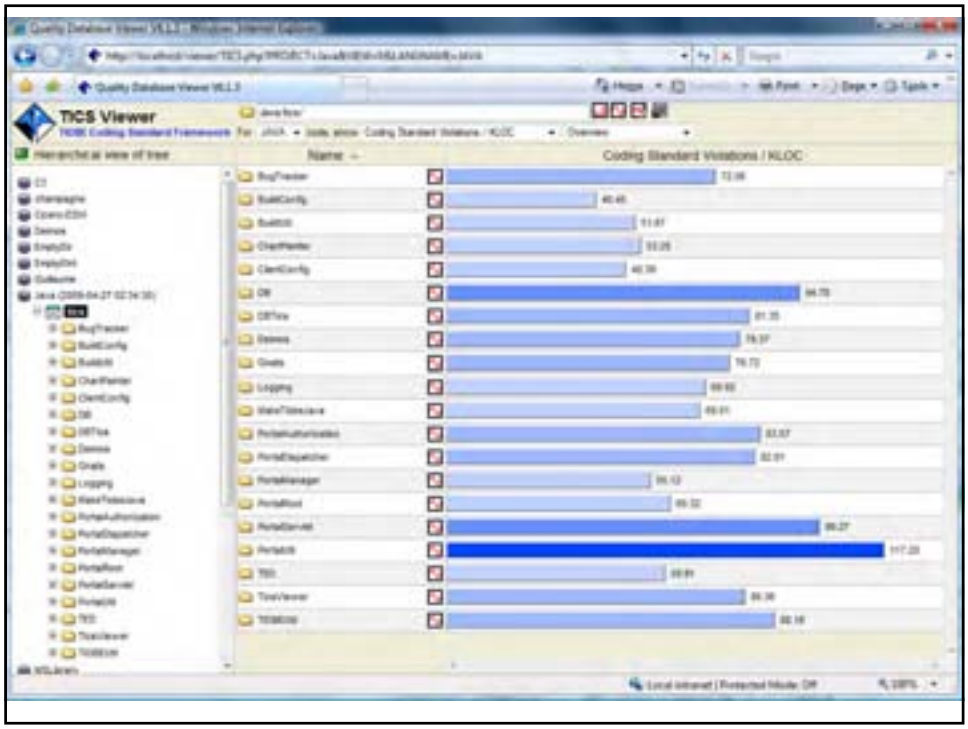

Coding Standard Violations Improved

- Problem: violations are not equally important
- Introduction of severity levels
  - Starting from 1 (most severe) to n (layout)
  - Severity levels defined by experts
  - New definition: violations/KLOC/severity level

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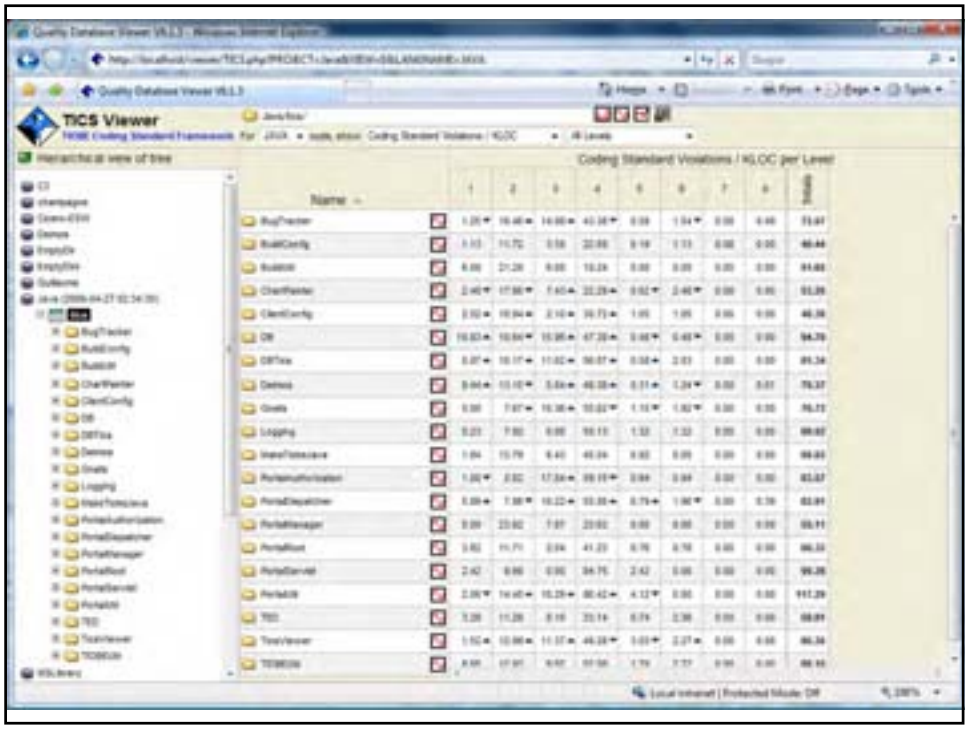
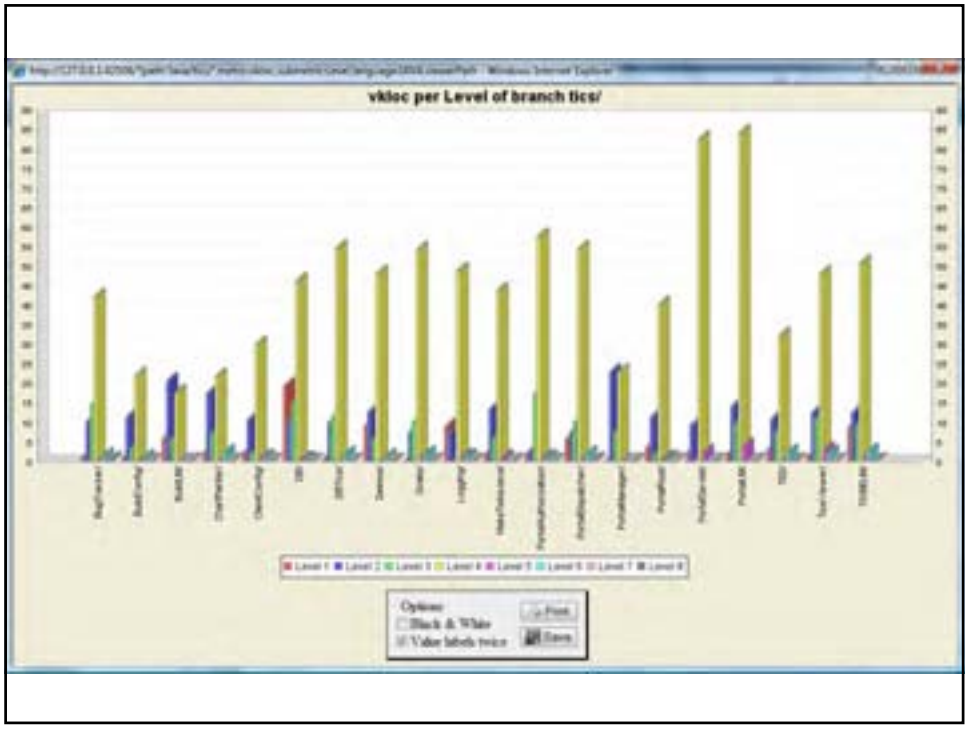
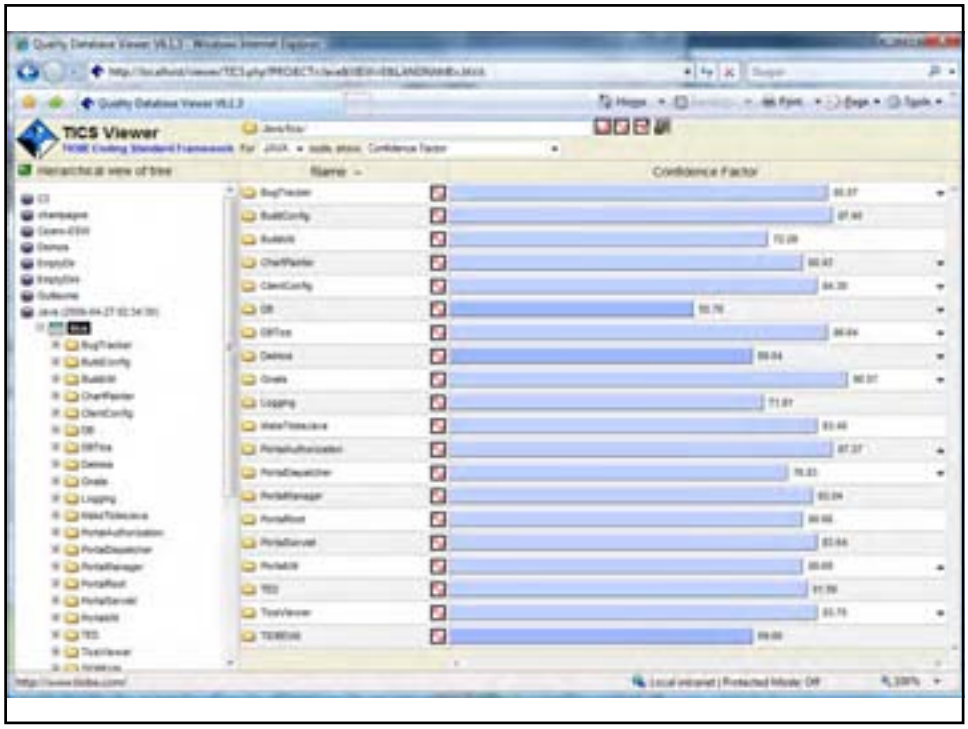




Coding Standard Violations Improved

- New problem: too much data
  - Nobody understands what is going on
- Introduction of confidence factor
  - Figure between 0% and 100%
  - Every severity level is 4 times less important
  - Normalization of weighted violation



Coding Standard Violations Improved

- What if a code checker fails to check a file?
  - Then the # violations will go down
  - And the confidence factor will go up!
  - Coverage of code checker should be used
  - Confidence factor is multiplied by coverage
- What if you add a coding standard rule?
  - Then the # violations will go up
  - And the confidence factor will go down!
  - Confidence factor should be divided by # rules

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Status Static Confidence Factor

- Used actively by most customers
- General confidence factor target is 80%
- Quarterly TIOBE QA Award:
  - Highest confidence factor
  - More than 500 KLOC
  - Less than 1 suppression/KLOC
- Q1 2009 won by Océ Varioprint 6250 team
  - Even feedback from Océ board of management

Success Factors Software Metrics

- Define what values are good/bad (set norms)
- Put the metric in practice *and let it evolve*
  - Make sure everybody is using the same metric
  - Collect as much as feedback as possible
- Make sure it is measured automatically
- Publish the results and benchmark

Two TIOBE Wake-up Calls

- Survey of Philips Healthcare MRI scanners:
  - Only 13% of field defects prevented
  - So the power of confidence factor is limited
- French customer company:
  - Based its incentives on confidence factor
  - It was the only thing they measured!

What's next?

- Measure and monitor more metrics
  - Based on ISO 9126 (21 quality factors)
  - Only 4 quality factors immediately applicable
- Functionality: test coverage
- Reliability: abstract interpretation
- Changeability: cyclomatic complexity
- Maintainability: static confidence factor

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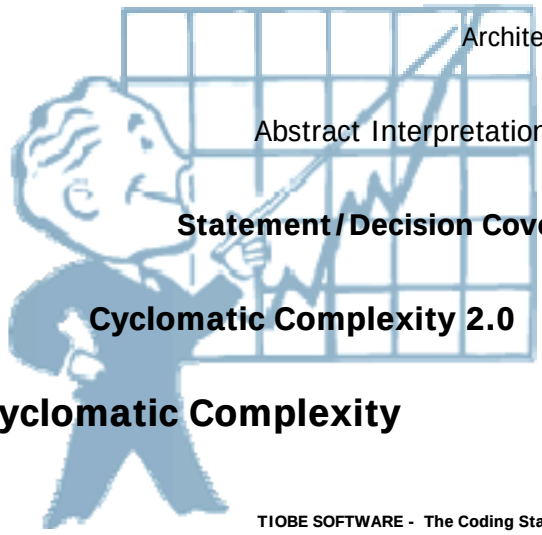
TIOBE's QA Award Roadmap



Architectural Rules

Abstract Interpretation Violations

Statement / Decision Coverage

Cyclomatic Complexity 2.0

Cyclomatic Complexity

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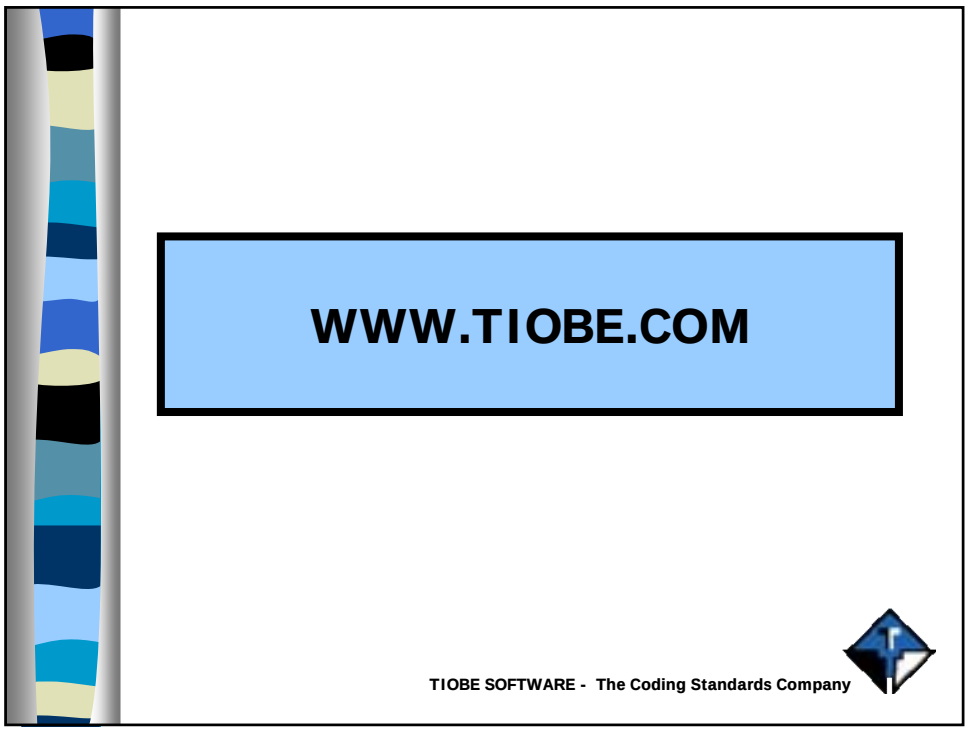
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